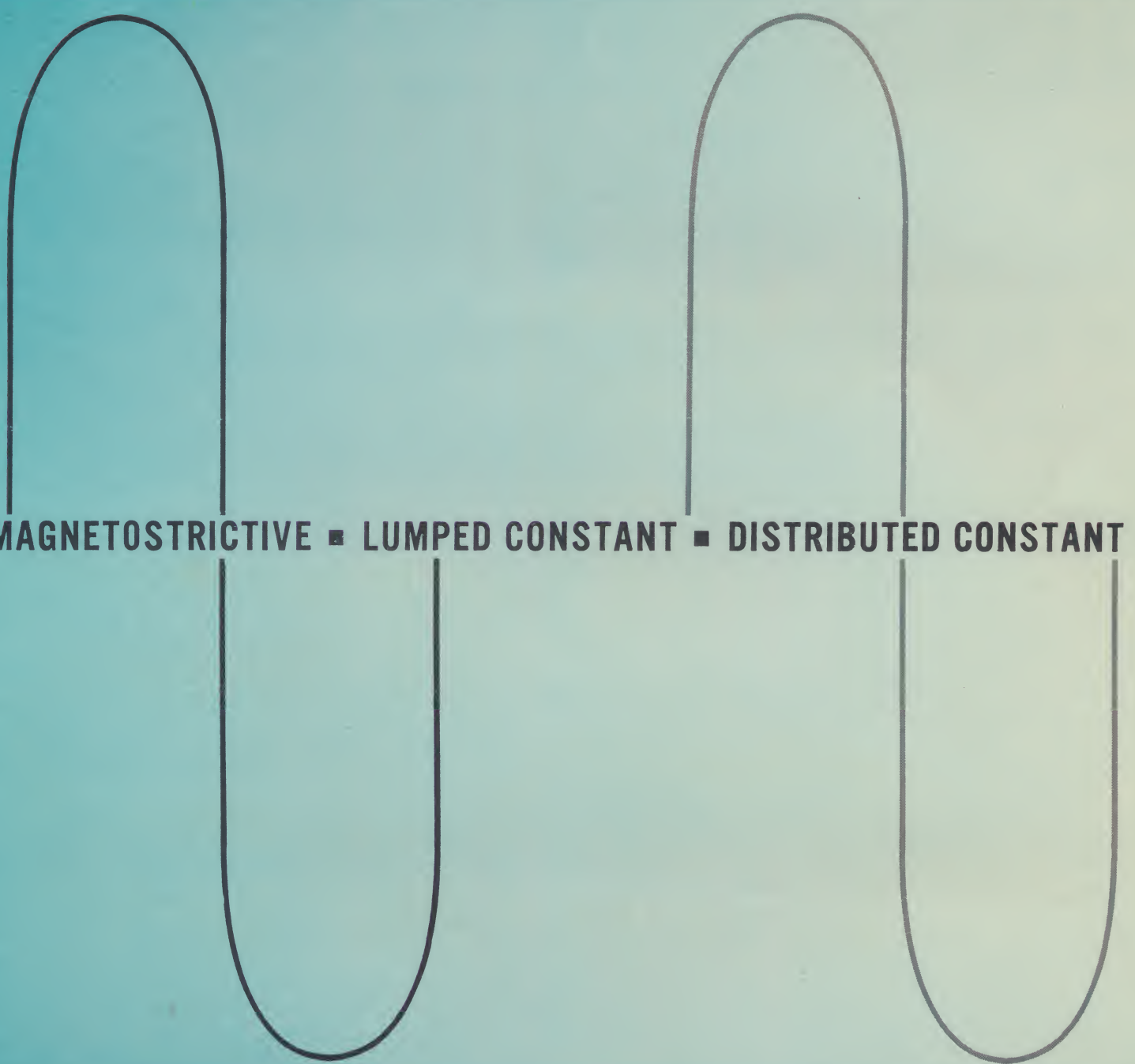


military & commercial

DELAY LINES



MAGNETOSTRICTIVE ■ LUMPED CONSTANT ■ DISTRIBUTED CONSTANT



CONTROL ELECTRONICS COMPANY, INC.

153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125

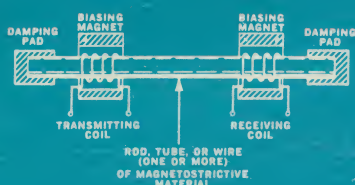
INTERNATIONAL SALES: EMEC Inc., 160 Terminal Drive, Plainview, N.Y. 11803
CABLE: Electronic, Plainview NEWYORKSTATE



To keep pace with a constantly improving technology, CEC offers a complete series of **tested** and **proven** Delay Lines to meet every requirement. At CEC, many years of experience go into supplying consistently high performance at lowest possible cost. Delay Lines shown here the typical, and are merely indicative of the wide range offered by CEC . . . most deliverable from off-the-shelf stocks. Custom-designed units with varying size, weight, volume, terminal or mounting configuration, delay to rise time, bandwidth, VSWR, etc., are also available at low production prices. For simplified ordering, use the handy CEC Engineering-Specification Card.

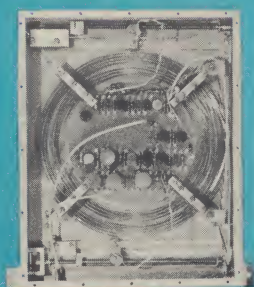
MAGNETOSTRICTIVE DELAY LINES

In magnetostrictive delay, an electrical signal is converted into a sonic wave which travels through a treated nickel alloy wire and is re-converted to an electrical signal at the "far" end of the wire. The wire length is an accurate measure of the delay time. CEC Magnetostrictive Delay Lines feature substantially long delay capability (to 10,000 microseconds in one unit) and low temperature coefficients (1.0 ppm/°C). Write for specification sheet MS-6402.



MAGNETOSTRICTIVE DELAY SCHEMATIC

Conversion to a sonic wave, then reconversion to an electrical signal, attenuates the signal as much as 70 db. Most electronic circuits cannot afford to suffer a 70 db loss in signal strength. However, CEC offers Magnetostrictive Delay Lines either without or with unity gain circuits which restore signal strength to its original level. When several delay lines are stacked in series for increased delays, each delay line should include unity gain output circuits to restore signal to its original level at the output of each line.



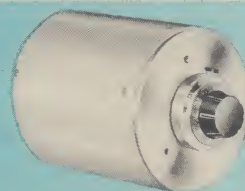
FIXED DELAY MAGNETOSTRICTIVE LINE

Delays to 5,000 microseconds available in 6" x 6" x 1" case; to 10,000 microseconds in 8" x 8" x 1". Circuitry for unity gain included.



SHORT DELAY — VARIABLE MAGLINES

Used as a variable or fixed delay line. Infinite resolution. Unique clutch arrangement at ends of stops. Ideal for PC boards.

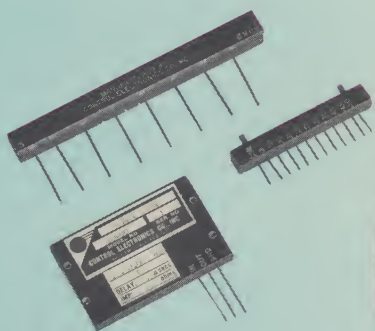


LONG DELAY — VARIABLE MAGLINE, KNOB ADJUSTABLE

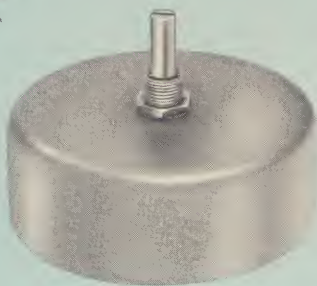
Up to 10,000 microseconds delay available in single units. Case dimension: 4" OD x 4½" long or 9" OD x 3½" long.

LUMPED CONSTANT DELAY LINES

Lumped Constant Delay Lines offer microsecond delay times in extremely compact packages. Delay is achieved through the usual LC circuits which are matched and designed to offer minimum attenuation of signal . . . for use without additional amplification. Units are hermetically sealed with temperature coefficients of approximately 45 ppm/°C. Write for Specification Sheet LC-6404.



COMPACT, FIXED DELAY LINE FOR PC BOARD APPLICATION—FULLY ENCAPSULATED
Many models with delays to 10 microseconds available . . . attenuation is only 1.0 db. All connections from one face for plugging into PC Board and dip soldering.



MINIATURE ROTARY VARIABLE DELAY LINE
Only 3" diam. x 1" high unit provides a variable delay line with delays to 3 microseconds . . . resolution 1:120. Sixty position selector switch can be supplied with motor drive.



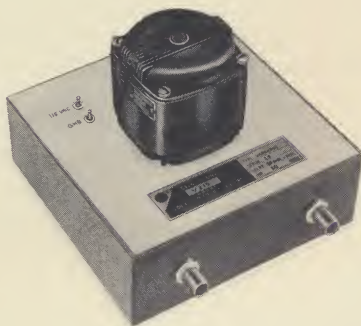
STEP VARIABLE DELAY LINE
Delays to 12 microseconds available in 60 steps or less. Can be supplied with motor drive. Dimensions: 4 1/4" x 4 1/4" x 1 1/4".



MINIATURE VARIABLE DELAY LINES—TO 2 MICROSECONDS
Can operate at 500 vdc. Screwdriver delay adjustment shown at right end of unit. Dimensions: 4 3/4" x 1 1/2" x 1 1/2".

HIGH FREQUENCY DELAY LINES

Delays with 500 Mc/s bandwidths available. Write for Specification Sheet HF-6401.

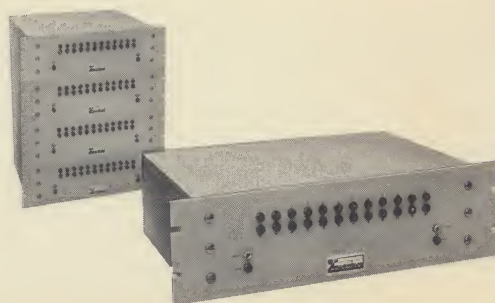


MOTORIZED VARIABLE DELAY

With extraordinarily high bandwidth.

AUDIO DELAY LINES

Delays to 100 milliseconds in one unit with excellent phase, attenuation, impedance and other specifications. Write for Specification Sheet AD-6402.



CASCADED DELAY CABINET

Weighs only 200 lbs. Provides delay of 100 milliseconds (four 25 ms units) with taps at every 1 ms . . . within 1%. Bandwidth: 400 cps.

DISTRIBUTED CONSTANT DELAY LINES

Distributed Constant Delay Lines employ a ground plane or metallic ribbon as the capacitance of an LC network . . . and are generally less expensive than Lumped Constant Delay Lines. Units are hermetically sealed with temperature coefficients of approximately 50 ppm/°C. Write for Specification Sheet DC-6401.



SQUARE UNIT

For easy mounting to PC board. All connector pins extend from one surface.



FIXED DELAY LINE

Compact and accurate with delays to 4 microseconds in this sections. Using several alternating "lines" running back and forth, any delay can be achieved.

Distributed by:

☐ SEND ADDITIONAL LITERATURE ON
THE FOLLOWING TYPE DELAY LINE

	fixed	tapped	variable
Lumped Constant	☐	☐	☐
Distributed "	☐	☐	☐
Magnetostrictive	☐	☐	☐

☐ All the above

☐ SEND A COPY OF "DELAY LINE
TERMINOLOGY"

☐ HAVE REPRESENTATIVE CALL ON ME.

☐ RECOMMEND A DELAY LINE TO MEET THE FOLLOWING
REQUIREMENTS AND QUOTE ON QUANTITIES OF _____

Delay _____ usec + _____ usec. With Taps at _____, _____, _____ usec
Input Pulse: Width _____ usec. Rise Time _____ usec
Input Current: _____ milliamps. Output Voltage: _____ millivolts
Output Pulse: Rise Time _____ usec or Frequency _____
Response _____ or Digital Bit Rate _____
Impedance: Input _____ ohms. Output _____ ohms
Attenuation: _____ db max. Spurious: _____ % max
Thermal Coefficient: _____ PPM/°C. Temp. Range _____ °C to _____ °C
If Variable: Range _____ usec to _____ usec. Resolution: _____
Environmental Specs: _____

Maximum Size:

Other Requirements: _____

Mr. _____

Title or Position

Company _____

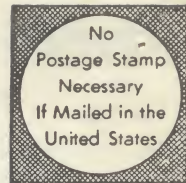
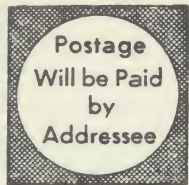
Address _____

Street _____

City _____ State _____ ZIP _____

Phone _____ Ext _____

Engineering-Specification Card



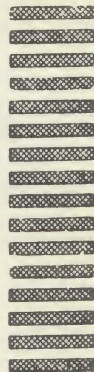
BUSINESS REPLY MAIL

First Class Permit No. 297, Farmingdale, New York



CONTROL ELECTRONICS COMPANY, INC.

153 Florida Street, Farmingdale, L.I., N.Y. 11735



☐ SEND ADDITIONAL LITERATURE ON
THE FOLLOWING TYPE DELAY LINE

fixed tapped variable

Lumped Constant ☐ ☐ ☐

Distributed " ☐ ☐ ☐

Magnetostriuctive ☐ ☐ ☐

☐ All the above

☐ SEND A COPY OF "DELAY LINE TERMINOLOGY"

☐ HAVE REPRESENTATIVE CALL ON ME.

RECOMMEND A DELAY LINE TO MEET THE FOLLOWING
REQUIREMENTS AND QUOTE ON QUANTITIES OF _____

Delay _____ usec + _____ usec. With Taps at _____, _____, _____ usec

Input Pulse: Width usec. Rise Time usec

Input Current: _____ milliamps. Output Voltage: _____ millivolts

Output Pulse: Rise Time _____ usec or Frequency _____

Response _____ or Digital Bit Rate _____

Impedance: Input _____ ohms. Output _____ ohms

Attenuation: _____ db max. Spurious: _____ % max

Thermal Coefficient: PPM/°C. Temp. Range _____ °C to _____ °C

If Variable: Range usec to usec. Resolution:

Environmental Specs:

Maximum Size:

Other Requirements:

Mr. _____

Title or Position

Company _____

Address _____

Street _____

City	State	ZIP
------	-------	-----

Phone _____ Ext _____

Engineering-Specification Card

Distributed Constant Delay Lines

GENERAL SPECIFICATIONS

for Standard and Custom Units

Construction	Encapsulated in Epoxy resin Moisture and fungus resistant Made to MIL specifications
Operating Temperature	—55°C to +125°C
Thermal Stability	.50 ppm/°C
Attenuation	0.8 db per μ sec. approximate
Test Voltage	500 Vdc



OPTIONAL FEATURES:

All Distributed Constant Delay Lines are offered in a choice of:
Round or Rectangular cross-section sticks

"FD" catalog designation is for Round $\frac{1}{32}$ " O.D. stick

"FDS" catalog designation is for Rectangular $\frac{3}{8}$ " x $\frac{1}{2}$ " stick

Pigtail or pin leads

Stud or insert mounting (FDS line only)

Tap points to your requirements

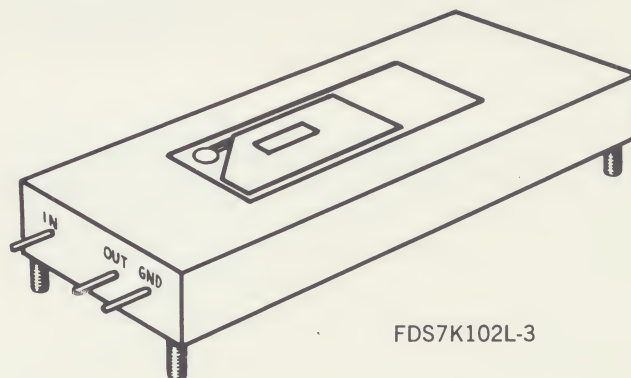
- LOWEST COST—RELIABLE PERFORMANCE
- SMALL SIZE, LIGHT WEIGHT
- IMPEDANCES: 200 TO 4000 Ω
- BANDWIDTHS TO 20 Mc/s
- LINEAR PHASE SHIFT

Delay μ sec $\pm 5\%$	Rise Time Less than μ sec*	CHARACTERISTIC IMPEDANCE $\Omega \pm 10\%$						
		300 (D)	500 (F)	1000 (K)	1500 (L)	2000 (M)	3000 (N)	4000 (Q)
.1	.014	FD7D101B	FD7F101B	FD7K101B	FD7L101B	FD7M101C	FD7N101C	FD7Q101C
.2	.029	FD7D201C	FD7F201C	FD7K201C	FD7L201C	FD7M201D	FD7N201D	FD7Q201D
.3	.043	FD7D301D	FD7F301D	FD7K301D	FD7L301D	FD7M301E	FD7N301E	FD7Q301E
.4	.057	FD7D401E	FD7F401E	FD7K401E	FD7L401E	FD7M401F	FD7N401F	FD7Q401F
.5	.071	FD7D501F	FD7F501F	FD7K501F	FD7L501F	FD7M501G	FD7N501G	FD7Q501G
.6	.085	FD7D601G	FD7F601G	FD7K601G	FD7L601G	FD7M601H	FD7N601H	FD7Q601H
.7	.10	FD7D701H	FD7F701H	FD7K701H	FD7L701H	FD7M701J	FD7N701J	FD7Q701J
.8	.115	FD7D801J	FD7F801J	FD7K801J	FD7L801J	FD7M801K	FD7N801K	FD7Q801K
.9	.130	FD7D901K	FD7F901K	FD7K901K	FD7L901K	FD7M901L	FD7N901L	FD7Q901L
1.0	.14	FD7D102L	FD7F102L	FD7K102L	FD7L102L	FD7M102M	FD7N102M	FD7Q102M
1.5	.21	FD7D152M	FD7F152M	FD7K152M	FD7L152M	FD7M152N	FD7N152N	FD7Q152N
2	.40	FD5D202J	FD5F202J	FD5K202J	FD5L202J	FD5M202K	FD5N202M	FD5Q152Q
4	.80	FD5D402N	FD5F402N	FD5K402N	FD5L402N	FD5M402P		

Longer delays than shown are provided by enclosing several sticks in one case.

e.g. 3 μ sec, using FDS7K102L-3, dimensions will be $\frac{3}{8}$ " x $1\frac{1}{2}$ " x 6"
10 μ sec, using FDS7K102L-10, dimensions will be $\frac{3}{4}$ " x $2\frac{1}{2}$ " x 6"

NOTE: number of sticks is designated by the numeral following the dash at the end of the catalog #. Thus FDS7K102L-3 designates 3 sticks.



FDS7K102L-3

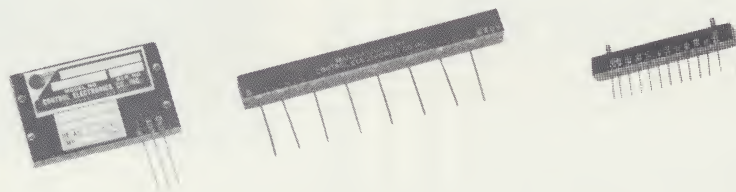


CONTROL ELECTRONICS COMPANY, INC.

153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125

Miniature Tapped Delay Lines

- **DELAY TOLERANCE:** $\pm 3\%$ or $\pm .01 \mu\text{sec}$
- **TAPS:** 10, equally spaced
- **THERMAL STABILITY:** 45ppm/ $^{\circ}\text{C}$
- **TEST VOLTAGE:** 500 Vdc
- **WORKING VOLTAGE:** 300 Vdc
- **PULSE VOLTAGE:** 50 volts peak
- **TEMPERATURE RANGE:** -50°C to $+125^{\circ}\text{C}$
- **LEADS:** #22 AWG tinned copper or brass



LC-6402

Delay $\mu\text{sec.}$	Maximum Output Rise Time $\mu\text{sec.}$	Bandwidth Mc/s	Impedance Range (Ohms)	Dimensions (inches)
0.05	.008	64	50-100	$\frac{1}{2} \times \frac{1}{2} \times 3$
0.1	.014	32	50-200	$\frac{1}{2} \times \frac{1}{2} \times 3$
0.2	.028	16	100-400	$\frac{1}{2} \times \frac{1}{2} \times 3$
0.3	.043	12	50-500	$\frac{1}{2} \times \frac{1}{2} \times 3$
0.4	.057	9	60-600	$\frac{1}{2} \times \frac{1}{2} \times 3$
0.5	.072	6.4	80-800	$\frac{1}{2} \times \frac{1}{2} \times 3$
0.6	.085	5.3	100-1000	$\frac{1}{2} \times \frac{1}{2} \times 3$
0.7	.1	4.6	100-1500	$\frac{1}{2} \times \frac{1}{2} \times 3$
0.8	.115	4	100-2000	$\frac{1}{2} \times \frac{1}{2} \times 3$
0.9	.129	3.5	100-2000	$\frac{1}{2} \times \frac{1}{2} \times 3$
1	.145	3.2	200-2000	$\frac{1}{2} \times \frac{1}{2} \times 3$
2	.286	1.6	250-1500	$\frac{1}{2} \times \frac{1}{2} \times 3$
3	.428	1.06	300-2000	$\frac{1}{2} \times \frac{3}{4} \times 3$
4	.57	0.82	500-1000	$\frac{1}{2} \times \frac{3}{4} \times 3$
5	.715	0.63	400-1000	$\frac{1}{2} \times \frac{3}{4} \times 3$
6	.85	0.53	500-1000	$\frac{1}{2} \times \frac{3}{4} \times 3$
7	.95	0.455	600-1000	$\frac{1}{2} \times \frac{3}{4} \times 3$
8	1.05	0.40	1000	$\frac{1}{2} \times \frac{3}{4} \times 3$
9	1.25	0.35	750	$\frac{1}{2} \times \frac{3}{4} \times 3$
10	1.4	0.32	500	$\frac{1}{2} \times \frac{3}{4} \times 3$

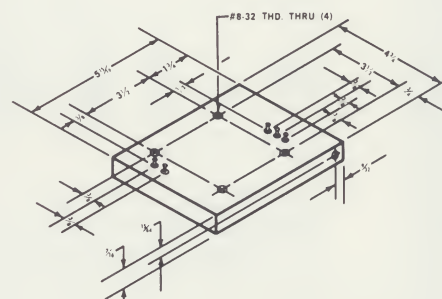
Compact Magline

Model	Delay	Adj. From Center Delay	Max. Pulse Rep. Rate	Attenuation
FM 401 Commercial 402 Military	50 to 1200 μsec	$\pm 4 \mu\text{sec}$	1 Mc/s	55-65 db

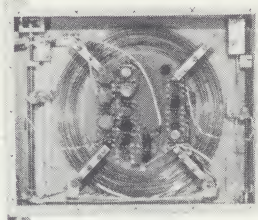
TYPICAL CHARACTERISTICS:

1. Input impedance 50Ω to $2000 \Omega^*$
2. Output termination 50Ω to $5K \Omega^*$
3. Signal to noise ratio 20:1
4. Change in delay with temp. $1 \times 10^{-5} \frac{\mu\text{sec}}{^{\circ}\text{C}}$ nominal
 $1 \times 10^{-5} \frac{\mu\text{sec}}{^{\circ}\text{C}}$ on order

*Specify when ordering



Magline Memory Systems



Model	Delay	PRR	S/N	Input Level
FMS 4013	5000 μsec	250 Kc/s	26 db	3-15 V
FMS 4037	4400 μsec	650 Kc/s	32 db	3-15V
FMS 4047	250 μsec	340 Kc/s	20 db	5V
FMS 4066	3500 μsec	850 Kc/s	35 db	6V



CONTROL ELECTRONICS COMPANY, INC.

153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125

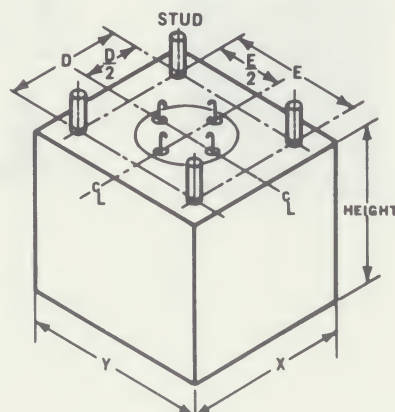
Lumped Constant Delay Lines

STANDARD UNITS

BUILT TO MIL SPECIFICATIONS

Ze in Ω $\rightarrow$ 50(A)		180(C)	500(F)	1,000(K)	1,500(L)	2000(M)	3000(N)	5000(R)	7500(R)	10000(T)
Time Delay μs	Rise Time μs	Code	Code	Code	Code	Code	Code	Code	Code	Code
.25	.015 .025 .05	F17A251AE F10A251AE F5A251AA	F17C251AE F10C251AE F5C251AA	F17F251AE F10F251AE F5F251AA		F5M251AE	F5N251AE			
.50	.03 .05 .10	F17A501AE F10A501AE F5A501AA	F17C501AE F10C501AE F5C501AA	F17F501CE F10F501AE F5F501AE	F5K501AE	F5L501AE	F10M501CC F5M501AE	F5N501AE		
1.0	.03 .05 .10 .20	F33A102CE F20A102CC F10A102AE F5A102AE	F33C102CE F20C102CC F10C102AE F5C102AE	F33F102CE F20F102CE F10F102CC F5F102AE	F10K102CC F5K102CC	F5L102CC	F10M102CC F5M102AE	F10N102CC F5N102AE	F5P102	
1.5	.05 .075 .15 .30	F30A152CE F20A152CC F10A152AE F5A152AE	F30C152CE F20C152CC F10C152AE F5C152AE	F30F152DE F20F152CE F10F152CC F5F152AE	F10K152CC F5K152CC	F10L152DE F5L152CC	F20M152DE F10M152CC F5M152AE	F10N152CC F5N152AE	F10P152CC F5P152AE	F10R152CC F5R152AE
5.0	.15 .25 .50 1.0	F33A502EF F20A502DE F10A502CC F5A502CE	F33C502EE F20C502CE F10C502CE F5C502CC	F33F502GD F20F502DE F10F502DE F5F502AE	F33K502GD F20K502JC F10K502CC F5K502AE	F10L502CC F5L502AE	F20M502DE F10M502CC F5M502AE	F20N502DE F10N502CC F5N502AE	F20P502DE F10P502CC F5P502AE	F10R502CC F5R502AE
10.0	3 5 1.0 2.0	F33A103GE F20A103EE F10A103EE F5A103CE	F33C103GD F20C103DE F10C103DE F5C103CC	F33F103GD F20F103GE F10F103CC F5F103AE	F33K103JD F20K103DE F10K103CC F5K103AE	F33L103JD F20L103DE F10L103CC F5L103AE	F33M103GD F20M203DE F10M103CC F5M103AE	F33N103GD F20N103DE F10N103CC F5N103AE	F20P103DE F10P103CC F5P103AE	F10R103CC F5R103AE
20.0	.6 1.0 2.0 4.0	F33A203GE F20A203GF F10A203EF F5A203CE	F33C203JC F10C203GD F10C203DE F5C203CC	F33F203GD F20F203DE F10F203CE F5F203CC	F33K203GD F20K203DE F10K203CE F5K203AE	F33L203GD F20L203DE F10L203CC F5L203AE	F33M203GD F20M203DE F10M203CC F5M203AE	F33N203GD F20N203DE F10N203CC F5N203AE	F33P203GD F20P203DE F10P203CC F5P203AE	F20R203DE F10R203CC F5R203AE
50.0	1.5 2.5 5.0 10.0	F33A503JF F20A503JC F10A503GE F5A503CE	F33C503JD F20C503JD F10C503DE F5C503CE	F33F503GF F20F503EF F10F503CE F5F503CC	F33K503GD F20K503EF F10K503CE F5K503CC	F33L503GD F20L503DE F10L503CE F5L503AE	F33M503GD F20M503DE F10M503CC F5M503AE	F33N503GD F20N503DE F10N503CC F5N503AE	F33P503GD F20P503DE F10P503CC F5P503AE	F33R503GD F20R503DE F10R503CC F5R503CC
100	3.0 10.0	F33A104JG F10A104GE	F33C104JF F10C104DE	F33F104GF F10F104CE	F33K104GF F10K104CE	F33L104GF F10L104CE	F33M104GD F10M104AE	F33N104GD F10N104AE	F33P104GD F10P104AE	F33R104GD F10R104AE
200	6.0 20.0	F33A204JL	F33C204JF F10C204GD	F33F204JF F10F204GD	F33K204JC F10K204EE	F33L204JC F10L204EE	F33M204GD	F33N204GD	F33P204GD	F33R204GD
500	15.0 50.0	F33A504JL	F33C504JL F10C504GD	F33F504JF F10F504GD	F33K504JF F10K504GD	F33L504JF F10L504GD	F33M504GF	F33N504JF	F33P504JF	

TAPPED AS REQUIRED



Height Letter	Code Size
A	1 1/2"
B	2"
C	2 1/2"
D	3"
E	3 1/2"
F	4"
G	4 1/2"
H	5"
J	5 1/2"
K	6"
L	6 1/2"
M	7"

BASE AND MOUNTING CODE

Letter	Base Size		Mounting Dimensions		Stud Size
	X	Y	D	E	
A	1 1/8	1 1/8	1 1/8	1 1/8	6-32 x 3/8
C	2 1/8	2 1/8	1 1/8	1 1/8	6-32 x 3/8
D	2 3/4	2 3/8	2 1/8	1 3/4	6-32 x 3/8
E	3 1/8	2 5/8	2 1/8	1 5/8	8-32 x 3/8
G	3 1/8	3 3/8	3	2 1/8	10-32 x 1/2
J	5 1/2	4 1/2	3 3/4	3	1/4-20 x 5/8

Tolerance $\pm 1/16$

Last letters of the catalog number indicate size.
Example: F10F501AE (here A indicates Base, E indicates Height)

DELAY TOLERANCE:
 $\pm 3\% \pm .01 \mu sec.$

IMPEDANCE TOLERANCE:
 $\pm 10\%$

ATTENUATION:
Less than .2 times the delay to rise time ratio

THERMAL STABILITY:
50 parts/million /°C

OPERATING TEMPERATURE RANGE:
-55°C to +125°C

SPURIOUS SIGNALS:
Less than 10%

Audio Delay Lines

BALANCED AND UNBALANCED

Model	Total Delay	Tol.	Max. Freq. for Delay Tolerance	Attenuation	VSWR	Impedance (ohms)	3 db Bandwidth	Dimensions (inches)
F135A	74.56 μ sec	1%	20,000 cps	1.0 db	1.0 db	1170	5 Kc/s	4 x 2.31 x 1.31
F330	61.20 μ sec	1%	15,000 cps	0.5 db	0.5 db	1100	25 Kc/s	4 x 2.31 x 1.31
F344	74.60 μ sec	1%	15,000 cps	0.5 db	0.5 db	1170	25 Kc/s	4 x 2.31 x 1.31
F416	1700 μ sec	1%	4,000 cps	3.0 db	1.0 db	1000	6 Kc/s	10 x 5 x 5
F437	208 μ sec	1%	5,000 cps	0.5 db	0.5 db	680	29 Kc/s	5 x 4.5 x 1.25
F444	98.736 μ sec	1%	15,000 cps	0.5 db	0.5 db	1170	25 Kc/s	4 x 2.31 x 1.31
F483	1000 μ sec	1%	10,000 cps	3.0 db	0.5 db	600	15 Kc/s	19 x 3 $\frac{1}{2}$ x 5 $\frac{1}{2}$ Relay Rack Mounting
FA784	5000 μ sec	1%	12,000 cps	12 db	1 db	600	5 Kc/s	19 x 5 $\frac{1}{4}$ x 13 $\frac{1}{2}$ Relay Rack Mounting

- **DELAY** to 25,000 microseconds
- **FREQUENCY** 5 cps to 100,000 cps
- **IMPEDANCE** to 10,000 ohms



LONG DELAYS



- **VERY LONG DELAY TIME**
- **LOW ATTENUATION**
- **EXCELLENT PHASE LINEARITY**

Specifications		25 Millisec Delay FA-573/25T	100 Millisec Delay FA-573/100T
Overall Delay		25 millisec	100 millisec
Characteristic Impedance		1000 ohms	1000 ohms
Number of Taps		25	100
Delay Between Taps		1 millisec $\pm$ 1/2%	1 millisec $\pm$ 1/2%
Attenuation	10 cps	2 db	8 db
	100 cps	2.6 db	10.4 db
	300 cps	5.5 db	22.0 db
Bandwidth		400 cps	400 cps
Phase Linearity		$\pm$.75% up to 300 cps	$\pm$.75% up to 300 cps
Size — Standard Retma Rack Cabinet Mounting		19" x 5 $\frac{1}{4}$ " x 10"	19" x 21" x 10"
Weight		50 lb.	200 lb.



CONTROL ELECTRONICS COMPANY, INC.

153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125

High Frequency Delay Lines

Delay Lines for operation at frequencies up to 500 megacycles are now being developed and produced to meet special requirements. Control Electronics offers to fill your high frequency delay line requirements. We are able to fill all the environmental and tolerance specifications that are presently being met with our lumped constant delay lines at lower frequencies. These high frequency delay lines are available in fixed and variable types or can be tapped at various delay points. They are made to meet applicable military specifications.

Characteristics of delay lines, developed by Control Electronics, for high frequency application are shown in the following table.



Model V215
125 Mc/s bandwidth

Characteristic	Model Number			
	V215	F258	F264	F272
Time Delay	0 to 50 n sec	10 n sec	50 n sec	200 n sec
Rise Time	—	—	10 n sec	16 n sec
Bandwidth	125 Mc/s	500 Mc/s	50 Mc/s	30 Mc/s
Impedance	50 ohms	50 ohms	100 ohms	120 ohms
Spurious	< 5%	< 3%	< 3%	< 3%
Attenuation (Pulse)	< 5%	< 1%	< 5%	< 10%
Terminals	BNC/Type N	BNC	WIRE LEADS	WIRE LEADS
Thermal Stability	50 PPM/°C	50 PPM/°C	50 PPM/°C	50 PPM/°C

Model V215 was specifically developed for use by the Radio Astronomy Station of the Harvard College Observatory in its Star Tracking experiments. It is designed for continuous motor driven application and is constructed with a rugged, printed circuit, commutator type switch having rhodium plated segments and a silver alloy wiper arm. Resolution is one part in 120.



CONTROL ELECTRONICS COMPANY, INC.

153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125

Variable Delay Lines

- CONTINUOUS ROTATION, or with mechanical stop
- SUITABLE FOR MOTOR DRIVE—we will supply units with motor drive to meet your specification



Model V203 4 1/4" x 4 1/4" x 1 1/4"

TYPICAL CHARACTERISTICS*

Model	Time Delay	Steps	Impedance (Ohms)	Rise Time	Attenuation	Max. Input (Volts)
V203	0.5 μ sec	4.2 nsec	580	35 nsec	.5 db	500
V226	0-120 nsec	1 nsec	100	15 nsec	.5 db	500
V227	0-0.3 μ sec	2.5 nsec	100	25 nsec	1 db	500
V228	0-0.3 μ sec	2.5 nsec	5000	40 nsec	2 db	500
V229	0-1.2 μ sec	10 nsec	2500	150 nsec	1 db	500
V230	0-3.0 μ sec	25 nsec	1000	250 nsec	1 db	500
V231	0-12 μ sec	100 nsec	250	750 nsec	6 db	300
V710	0-6 μ sec	50 nsec	1000	300 nsec	2 db	500
V743	0-.1 μ sec	0.833 nsec	75	15 nsec	.5 db	500
V745	0-5 μ sec	42 nsec	100	250 nsec	2 db	500

*Characteristics can be varied to suit your needs.

Control Electronics' miniature series of rotary variable delay lines are 1" high and only 3" in dia. These lines are ruggedly constructed and hermetically sealed to provide high reliability and a long service life. The delay variation is selected by a 60 position shorting type rotary switch. This shorting feature provides an intermediate delay of $\frac{1}{2}$ step so that the resolution is one part in 120. This switch, designed by Control Electronics, can be motor driven at speeds in excess of 10 rpm, and has been life tested for over 1,000 hours of continuous use.



Model V397

Model	Time Delay	Rise Time	Impedance (Ohms)	Attenuation
V364	0 to .1 μ sec	.01 μ sec	50	.5 db
V365	0 to .2 μ sec	.01 μ sec	50	1 db
V390	0 to 3.0 μ sec	.25 μ sec	750	2 db
V397	0 to 1.2 μ sec	.10 μ sec	1000	1 db
V440	0 to 1.5 μ sec	.15 μ sec	500	2 db



CONTROL ELECTRONICS COMPANY, INC.

153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125

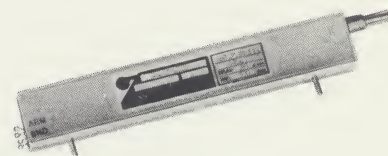
Variable Delay Lines

- **RESOLUTION:** Better than .001 μsec .
- Can be terminated externally or internally.
- All models are hermetically sealed.

- Can be operated above ground potential.
- **DC WORKING VOLTS:** 500 volts max.
- High impedance tap (variable)

Model	Min. Delay at Max. Delay Setting	Maximum Pulse Rise Time*	Impedance (Ohms)
VR 900	.10 μsec	.025 μsec	100
VR 901	.20 μsec	.030 μsec	200
VR 902	.70 μsec	.080 μsec	500
VR 903	.95 μsec	.090 μsec	500
VR 904	.50 μsec	.055 μsec	750
VR 905	.40 μsec	.040 μsec	1000
VR 906	.25 μsec	.030 μsec	1300
VR 907	.20 μsec	.030 μsec	1500

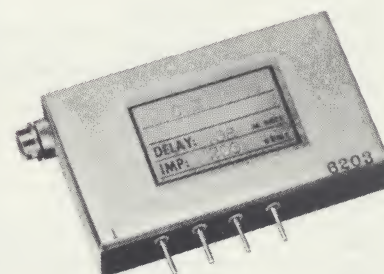
*Rise time at maximum delay setting.



- **ATTENUATION:** Less than 1.5 db.
- **OPERATION:** Continuously variable shaft rotation of 10 turns from zero to maximum delay
- **OUTSIDE DIMENSIONS:** $7\frac{1}{2} \times \frac{3}{4} \times 1\frac{1}{4}$
- Locking device optional at no extra charge

Model	Min. Delay at Max. Delay Setting	Maximum Pulse Rise Time*	Impedance (Ohms)
VS 950	0.75 μsec	0.25 μsec	390
VS 951	0.62 μsec	0.206 μsec	470
VS 952	0.50 μsec	0.16 μsec	560
VS 953	0.37 μsec	0.125 μsec	680
VS 954	0.25 μsec	0.085 μsec	1000
VS 955	0.125 μsec	0.042 μsec	1000
VS 956	0.062 μsec	0.021 μsec	1500
VS 957	0.125 μsec	0.042 μsec	1800
VS 958	0.080 μsec	0.027 μsec	200

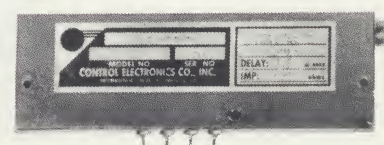
*Rise time at maximum delay setting.



- **ATTENUATION:** 0.5 db max.
- **OPERATION:** Continuously variable shaft rotation of $2\frac{1}{2}$ turns from zero to maximum delay.
- **OUTSIDE DIMENSIONS:** $2\frac{3}{8} \times \frac{1}{2} \times 1\frac{1}{2}$

Model	Min. Delay at Max. Delay Setting	Maximum Pulse Rise Time*	Impedance (Ohms)
VL 1000	1.50 μsec	.30 μsec	390
VL 1001	1.25 μsec	.25 μsec	470
VL 1002	1.0 μsec	.20 μsec	560
VL 1003	0.75 μsec	.15 μsec	680
VL 1004	0.50 μsec	.10 μsec	1000
VL 1005	0.25 μsec	.04 μsec	1000
VL 1006	0.125 μsec	.03 μsec	1500
VL 1007	0.25 μsec	.06 μsec	1800

*Rise time at maximum delay setting.



- **ATTENUATION:** Less than 1.0 db.
- **OPERATION:** Continuously variable shaft rotation of 5 turns from zero to maximum delay.
- **OUTSIDE DIMENSIONS:** $4\frac{3}{4} \times \frac{1}{2} \times 1\frac{1}{2}$



CONTROL ELECTRONICS COMPANY, INC.

153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125

LC-6401

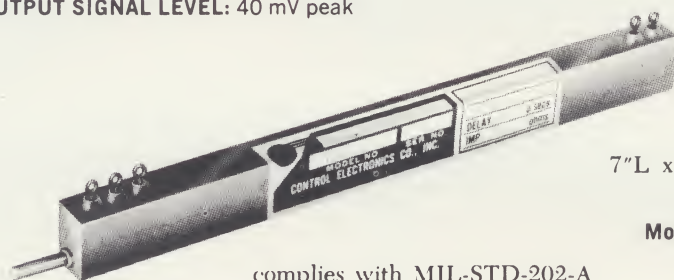
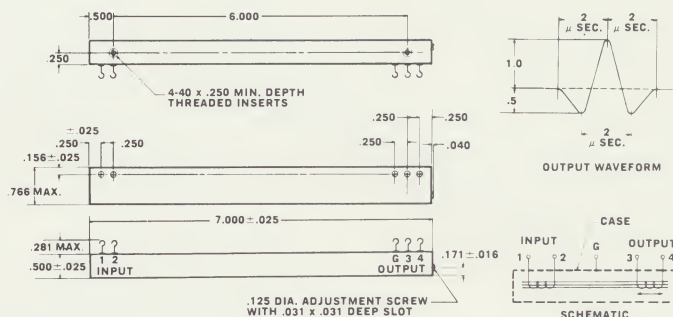
Variable Maglines

- **TIME DELAY:** 2-22 μsec
- **OPTIMUM INPUT PULSE WIDTH:** 1.0 $\mu\text{sec} \pm .2 \mu\text{sec}$
- **MAXIMUM PRF:** 500 Kc/s
- **MAXIMUM AVERAGE POWER INPUT:** 0.1 watt
- **IMPEDANCE RANGE FOR INPUT OR OUTPUT:** 50 to 4000 ohms

Line is stocked in 700 ohm input and output impedance and has the following specific characteristics:

MAXIMUM PULSE VOLTAGE TO REACH SATURATION LEVEL: 40 V peak

MAXIMUM OUTPUT SIGNAL LEVEL: 40 mV peak

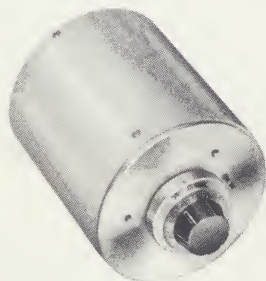


7"L x .5"W x .766"H

Model VM1020

complies with MIL-STD-202-A

Model VM1030



Model VM1090



MODEL VM 1030	SPECIFICATIONS	MODEL VM 1090
3 to 500 μsec	Delay Range	3 to 4000 μsec
50 ohms to 4K ohms	Impedance Range	50 ohms to 4K ohms
3 μsec	Min. Pulse Spacing	3 μsec
12 mv	Output when driven with 15 V Pk. - 1 μsec pulse	6 mv
10	Turns for full delay	28
4" O.D. x 4.5" L	Size	9" O.D. x 3 3/8" L
2 lb.	Weight	5 lb.



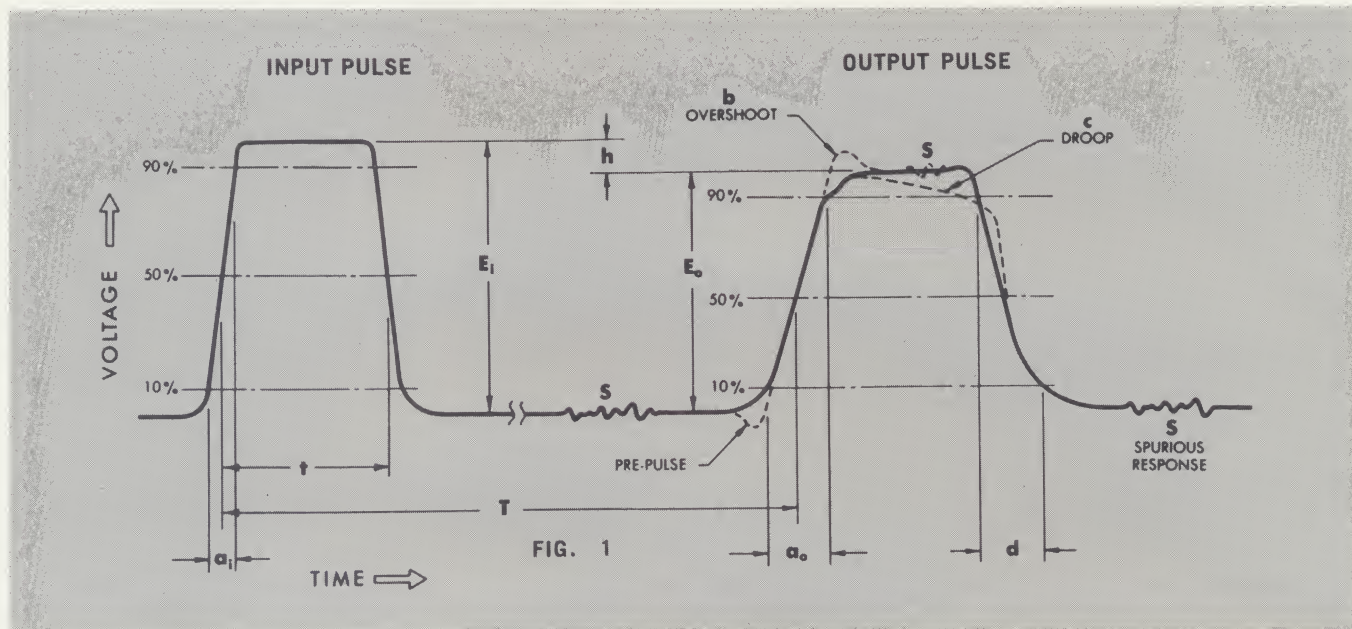
CONTROL ELECTRONICS COMPANY, INC.

153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125

Delay Lines

Terminology

In order to evaluate and specify your delay line requirements, it is helpful to be familiar with the terminology. The terms most often used to describe and specify delay line characteristics are given below. Where appropriate they're shown on Fig. 1. Dashed lines show common variations in output waveshape.



a RISE TIME...

a_i Input pulse rise time

a_o Output pulse rise time

a_n Network pulse rise time

$$a_n = \sqrt{(a_o)^2 + (a_i)^2} \text{ approx.}$$

b OVERSHOOT... A continuation of the leading edge of the pulse

c DROOP... A sloping of the top of the pulse

d FALL TIME...

$$h \text{ ATTENUATION (in db)} = 20 \log \frac{E_i}{E_o}$$

S SPURIOUS RESPONSE—Distortion—Ripple... Three common terms used to define any irregularities in the signal output of the delay line due to various causes. This may be expressed as db below E_o

t PULSE WIDTH... Usually measured at 50% amplitude points.

T DELAY TIME... The pulse delay is usually measured from the 50% amplitude point of the leading edge of the input pulse to the 50% amplitude point of the leading edge of the output pulse.

CHARACTERISTIC IMPEDANCE, Z_0 ... Characteristic impedance of the delay line is the impedance presented to an input pulse applied to the delay line. A delay line is usually terminated in a resistance equal to the characteristic impedance.

DELAY/RISE TIME RATIO, T/a_n ... The ratio of total delay to the delay line rise time is one measure of the quality of the delay line.

BANDWIDTH... Those frequencies which are passed at a useful amplitude (attenuated 3 db or less, for example). This is related to rise time approximately by

$$\text{bandwidth} \times \text{rise time} = .4$$

TEMPERATURE COEFFICIENT... Usually expressed as a percent change in delay per degree Centigrade.

PHASE SHIFT... Delay lines may be used as phase shifting devices. A delay line will shift the phase of a sine wave an amount in degrees equal to $360 \times \text{delay time} \times \text{frequency of sine wave}$. $\theta = 360 \times T \times f$.



CONTROL ELECTRONICS COMPANY, INC.

153 Florida Street, Farmingdale, L.I., N.Y. 11735 • (516) 694-0125

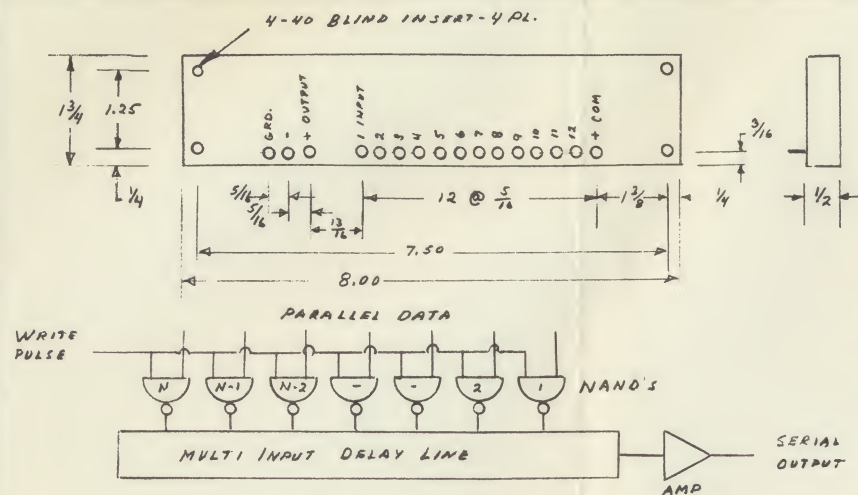


FIG. 1 FUNCTIONAL DIAGRAM

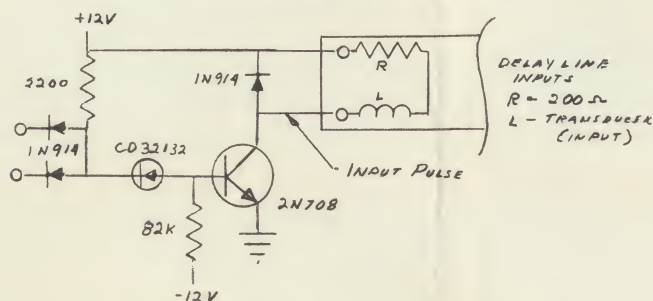


FIG. 2 APPLICATION CIRCUIT (NAND)

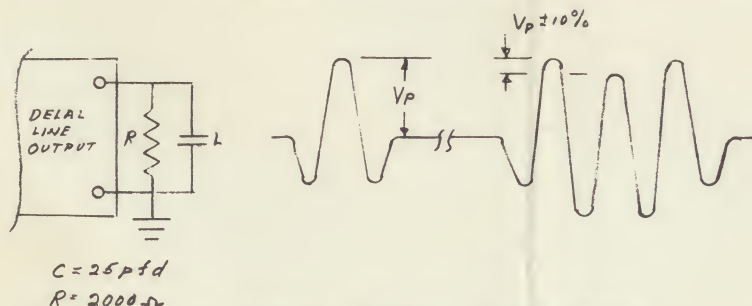


FIG. 3 OUTPUT WAVEFORMS

CODE GENERATOR

Delay Line Model DM718 is representative of a series of multi-tapped Magnetostrictive Delay Lines that are intended for use as word generators, serial to parallel or parallel to serial converters in digital computers or as recognition code train generators in radar systems. A wide choice of tap spacings and number of taps is available with tap spacings from .2 usec to several hundred microseconds being readily achievable. As many as 16 taps at a spacing of 1 usec are provided in the same case size as that of the DM718.

Electronic circuits to restore the signals to input logic level and to match system requirements are also supplied.

Specifications for Delay Line Model DM718

- 1.0 General Description
Delay Line Model DM718 is a 12 input Magnetostrictive Delay Line intended as a real time parallel to serial converter. Ref. Fig. 1.
- 2.0 Electrical Specifications
 - 2.1 Input Ref. Fig. 2
 - 2.2 Input pulse width: 0.40 $\pm$ 0.05 usec.
 - 2.3 Input rise and fall time: 0.05 usec Max.
 - 2.4 Output Ref. Fig. 3
 - 2.5 Output amplitude (V_p) 20 mv Min.
 - 2.6 Signal/Noise Ratio: 5:1 Min.
 - 2.7 Amplitude variation: $\pm$ 10% Max.
 - 2.8 Crosstalk between inputs and outputs: Less than 1 to 3
- 3.0 Delay Specifications:
 - 3.1 Tap Spacing (at 25°C): 1.25 usec $\pm$.05 usec
 - 3.2 Tap #1 to Output 1.75 usec $\pm$.25 usec
 - 3.3 Number of Input taps 12
- 4.0 Environmental
 - 4.1 Operating Temperature Range: 0 to 50°C
 - 4.2 Storage Temperature Range: -55 to +85°C
 - 4.3 Applicable Mil. specifications Mil. Std. 202B
 - 4.3.1 Method 102A Test Condition D
 - 4.3.2 Method 103A Test Condition B
 - 4.3.3 Method 201A
 - 4.3.4 Method 202A 50 g 1 blow
- 5.0 Construction and Marking
 - 5.1 Construction Solder sealed steel case
 - 5.2 Weight 8 oz.
 - 5.3 All taps shall have a common return

COMPUTER DEVICES CORP.
6 WEST 18 STREET
HUNTINGTON STA., NEW YORK

CODE GENERATOR
Delay Line Model DM718

MAT.	DATE
DWG	REV.

DELAY LINES

TO
MILITARY
AND
COMMERCIAL
SPECIFICATIONS

New products for 1965

SUB-MINIATURE VARIABLE DELAY LINE

SIZE: .3 x .3 x .8 in.

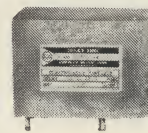
V982	—1	—2	—3	—4
Delay Nanosec.	3-25	3-30	4-50	5-100
Impedance Ohms	1000	500	270	50
Rise Time Nanosec.	20	25	40	90



V982

ELECTRICALLY VARIABLE DELAY LINES • LOW DISTORTION • DELAY LINEAR FUNCTION OF VOLTAGE

Model	Delay Range microsec.	Rise Time microsec.
DEV997	.01-10	0.2
DEV998	1-1000	20
DEV999	10-10000	200 Kc



DEV999

(See CORRELATION D.L. below)

LUMPED CONSTANT DELAY LINES

FIXED AND TAPPED DELAYS

CODING LINES for Radar Recognition Sets — Tap spacing 1.45 μ sec. Accuracy up to $\pm 0.02 \mu$ sec over Mil. specs. Lumped Constant hermetically sealed units — Other special tap spacings are also provided — Lines may be used for encoding or decoding —

*Equalizing Resistors included in package.

Model	Delay Microsec.	Rise Time Microsec.	Step or Tap Delays μ sec.	Imped. Ohms	Attenuation db	Size
D1000	20.3	.5	1.45	330	6	2 x 4 x .31
D389	20.3	.4	1.45	330	4	4 x 4 x .37
D637	20.3	.3	1.45	180	10*	2.37 x 2.75 x 3.18
D203	20.3	.35	1.45	470	3	10 x 2.5 x 2.25
D170	20.3	.60	1.45	510	3	4 x 2 x 1
D231	20.3	.50	1.45	2200	2	4 x 3 x 2
D978	24.65	.45	2.90	180	6*	7.5 x 4 x 2
D297A	24.65	.50	1.45	500	3	2.87 x 2 x 4.25
D298A	25.3	.50	Special	500	3	2.87 x 1.62 x 4.25

TYPICAL LUMPED CONSTANT TYPES — Large variety of performance characteristics available. Delay to rise time ratios of up to 175 to 1 — accuracies up to .1% over Mil. Spec. range. Hermetically sealed in metal containers.

D702	2.5	.075	.05	220	3	3.5 x 5.5 x 1.0
D992	6.0	.3		1000	2	1.37 x 1.37 x 2.5
D148	10.0	.3		1000	3	2.12 x 2.12 x 4
D754	50	1.5	.5	1000	6	4 x 4 x 2
D414	100	3.0	1.0	500	4	6 x 3.5 x 3

AUDIO DELAY AND SONAR LAG LINES

FIXED AND TAPPED DELAYS of low frequency C.W. signals. High accuracy of delay — Temperature stability 40 PPM/ $^{\circ}$ C, VSWR $\pm 1/2$ db. Phase linearity $\pm 1/4\%$.

*DA921 has VSWR of ± 1 db.

Model	Delay Microsec.	3 db B.W. Kc	Step or Tap Delays μ sec.	Imped. Ohms	Attenuation db	Size
*DA921	420	100		2000	4	14 x 2 x 1
DA563	500	30	25	1000	6	7 x 2.5 x 2
DA301	1000	20	20	600	3	19 x 3.5 x 9
DA261	5000	5	40	500	3	19 x 5.25 x 10
DA607	20000	3.5	80	500	1	19 x 7 x 15
DA177	100000	.2	1000	1000	10	19 x 21 x 12

VARIABLE DELAYS — Decade insertion type switching — provides low signal distortion and input and output impedance of equal value — Other characteristics same as fixed line.

AV175	0 - 150	30	.1	500	6	9 x 3 x 6
AV287	0 - 500	20	.002	1000	3	19 x 3.5 x 12
AV206	0 - 1000	20	1.0	600	3	19 x 3.5 x 12
AV731	0 - 5000	5	.1	1000	2	19 x 5.25 x 15
AV211	0 - 10000	2.5	.1	600	3	19 x 5.25 x 15

VARIABLE DELAYS

One Turn Movable tap on coil type.
Multi-Turn Movable tap on coil type.
Multi-Turn Movable tap on coil type.
Multi-Turn Movable tap on coil type.
Multi-Turn Movable tap on coil type.
Phase Shifter for up to 200 Kc.

INFINITE RESOLUTION — Inductive pick-off — Distributed Constant.

Model	Delay Range Microsec.	Rise Time Microsec.	Resolution	Imped. Ohms	Attenuation db	Size
DV252	0 - .06	.02	1/300	330	.5	1.5 dia. x .75
V172	0 - .55	.08	1/1000	1000	1	.5 x 1.5 x 4.5
V289	0 - 1.0	.2	1/1000	500	1	.5 x 1.5 x 4.5
DV219	0 - 1.0	.11	1/1000	1000	1	.62 x 1.25 x 6.5
V176	0 - 3	.5	1/1000	330	2	.75 x 1.87 x 7
V649	0 - 10	1.8	1/2000	100	4	2 x 2 x 8
VP162	0 - 7	.3	Infinite	150	30	2 x .75 x 5
VP333	0 - 12	1.2	Infinite	10000	30	1.37 dia. x 10

ULTRA MINIATURE VARIABLES

NANOSECOND RANGE COMPUTER TRIM-DELAYS. Hermetically sealed in metal cases — "O" ring seal on control shaft — for printed circuit board mounting. Can be cascaded with Series D647.

Model	Delay Range Nanosec.	Rise Time Nanosec.	Resolution Nanosec.	Imped. Ohms	Attenuation db	Size
V447-1	0 - 55	15	.5	150	1	1 x .31 x 1.25
V447-2	0 - 100	30	.7	50	1	1 x .31 x 1.25
V447-3	0 - 150	25	.6	150	1	1 x .31 x 2.45
V447-4	0 - 250	30	1.0	50	1.5	1 x .31 x 2.45
V447-5	0 - 300	30	.6	150	1.5	1 x .31 x 3.45
V447-6	0 - 500	60	1.0	50	2	1 x .31 x 3.45
DV875	0 - 100	20	.3	1000	1	1 x .31 x 3.45
DV810	0 - 200	40	.6	1000	1	1 x .31 x 2.45
V975	0 - 40	10	.02	200	1	1 x .31 x 2.45
V887	0 - 300	60	1.0	75	2	1 x .31 x 2.45

D647 SERIES — MINIATURE MODULES

Lumped Constant Printed circuit mounting modules can be cascaded to obtain any desired delay. Case size depends on delay to rise time required. Units are compatible with variable V447 series.

* Tapped each 1.45 μ sec. for use in coders.

Delay Choice	Choice Imped.	Delay to Rise Time Ratio	Size
50; 100; 250; 500 and 750 nanosec.	50 ohms		1 x .31 x 1.25
1.0; 1.45; 2.90* and 4.35* microsec.	150 ohms and 500 ohms	4:1 8:1 12:1	1 x .31 x 2.20 1 x .31 x 3.45

DO IT YOURSELF DELAY ADJUSTMENT

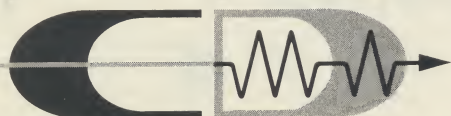
5 completely separate sections in each module. Cascaded modules allow selection of any desired delay in 5 nanosec. increments. Ideal for experimental work. Size of all modules 1 x .31 x 2.25 for printed circuit mounting.

Part No.	Section Delay — Nanosec.	Tot. Delay Nanosec.	Rise Time Nanosec.
Imp. 93 Ω			
D740	5; 10; 20; 30; 40	105	15
D742	50; 100; 200; 300; 400	1050	150
D744	One Delay	100	15
D746	One Delay	1000	150

ELECTRICALLY VARIABLE

Delay is varied by varying a D.C. control voltage. Both L & C are controlled to minimize mismatch.

Model	Delay μ sec.	Rise Time μ sec.	Distortion %	Imped. Ohms	Attenuation db	Size
DEV623A	.03 to .04	.008	10	150	2	2 x 1 x .31
DEV350	3 to 7	.25	10	1000	3	3.5 x 4 x 4

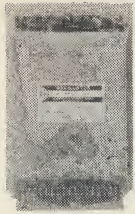


COMPUTER DEVICES CORP.

6 W. 18TH STREET, HUNTINGTON STA., L.I., N.Y.

TEL: 516 - AR1-0666, TWX: 516 - 421-4235

New products for 1965



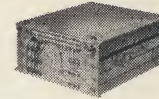
STABLE OSCILLATOR

Frequency — .1 cps to 25 Kc
 Accuracy — .001% standard
 up to — .0002% special
 Stability — 0°C to 50°C
 .005% Std. to .0005% special
 Featuring — adjustable frequency
 and/or Electrically Variable
 Size — 5 x 7 x 1.12

M0965

COMPUTER MEMORY
FOR AIRBORNE USE

For airborne use
 24,000 bits Max. stor.
 3 separate channels
 2 Mc clock rate
 Size — 7 x 5.87 x 3
 To MIL specs



MA917

**DELAY
LINES**
 TO
 MILITARY
 AND
 COMMERCIAL
 SPECIFICATIONS

WIRE SONIC — MAGNETOSTRICTIVE DELAY LINES

FIXED DELAYS

	Model	Maximum Delay Microsec.	Max. Bit Rate RZ or C.W. Cent. Freq. Mc.	Size
LONGITUDINAL MODE — Short delays with ± 4 μ sec trim adjustment; standard temperature coefficient 150 PPM/°C, provided as low as 2 PPM/°C.	ML545A	23	2.0	1 x 5 x .375
	ML755A	20	2.5	1 x 6 x .375
	ML756A	50	2.0	2 x 8 x .375
	ML757	100	1.5	2 x 14 x .375
TORSIONAL MODE — Ultra stable with temperature coefficient less than .5 PPM/°C available. Signal to spurious noise 10:1 dynamic 30:1 static. All units provide a ± 4 μ sec adjustment. Unsealed or hermetically sealed to meet MIL specs.	MT762A-1	250	2.5	4 x 5 x .50
	MT762A-2	500	2.0	4 x 5 x .50
	MT762A-3	2000	1.5	4 x 5 x .50
	MT763A-1	3000	1.5	6 x 7 x .50
	MT763A-2	5000	1.2	6 x 7 x .50
	MT765A-1	10000	1.0	10.5 x 11.5 x .56
	MT765A-2	15000	0.75	10.5 x 11.5 x .56

SERIAL COMPUTER MEMORIES

	Model	Maximum Storage Bits RZ	Maximum Bit Rate RZ — MC	Size
COMPLETE UNITY GAIN MEMORY SYSTEMS supplied with transistorized circuitry for operation in any required mode RZ, NRZ or Bi-Polar. These units use the MT760 Delay Line series and have the exceptional stability and high signal to noise ratio of these Delay Lines. Can be cascaded and complete memory stacks are also provided. Maximum storage can be doubled by operating in the NRZ mode.	MS772B-1	625	2.5	4.5 x 6.20 x 1.12
	MS772B-2	1000	2.0	4.5 x 6.20 x 1.12
	MS772B-3	3000	1.5	4.5 x 6.20 x 1.12
	MS773A-1	4500	1.5	8 x 10.5 x .62
	MS773A-2	6000	1.2	8 x 10.5 x .62
	MS775A-1	10000	1.0	12.0 x 15.0 x .7
	MS775A-2	11250	.75	12.0 x 15.0 x .7

VARIABLE DELAYS

	Model	Delay Range Microsec.	Max Bit Rate RZ MC	C.W. B.W. MC	Size
SINGLE SHAFT CONTROL provides infinite resolution over a wide range of delays. Ideal for Radar Range Calibration, Simulation or Correlation work. 6 decade switch system provides .1 μ sec resolution.	MV994	2-18	2.0	1.5-2.5	1 x 5 x .5
	MV781A	2-30	2.0	1.5-2.5	1 x 9 x .5
	MV782	30-100	1.0	.8-1.2	2 x 15 x .5
	MV784	10-5000	.3	.2- .4	10.0 Dia. x 8
	MV785	10-100,000	1.0	.8-1.2	19 x 17 x 10.5

CORRELATION DELAY LINES — ELECTRICALLY VARIABLE

	Model	Max. Delay Seconds	Frequency Response	Size
LONG DELAYS OF COMPLEX SIGNALS with very little distortion. Ideal for correlation work. Supplied as: Fixed Delays; Multi-tap Delays; Variable Delays by means of switches or as an Electrically Variable system wherein delay is a function of a control voltage.	MA574	.01	10 cps to 50 Kc	12 x 12 x 3
	MA880	.03	10 cps to 50 Kc	12 x 22 x 18
	MA1005	.10	10 cps to 25 Kc	15 x 22 x 18
	MA1006	1.0	10 cps to 10 Kc	24 x 27 x 49

MULTIPLE OUTPUT DELAYS

	Model	Total Delay Microsec.	No. of Taps	Tap Spacing or Location Microsec.	Size
CODE GENERATORS — Provide as many tap positions as desired at any spacing desired (.2 μ sec min.). Fast rise times. Also provided with in and out circuitry. Used as parallel to serial and serial to parallel converters.	ML790	16	16	1.0	1.75 x 8 x .50
	ML718	15	12	1.25	1.75 x 8 x .50
	ML791	20.3	14	1.45	1.75 x 8 x .50
	ML883	28	24	1.0	3 x 9.37 x .50
MULTIPLE OUTPUTS — Adjustable independently over range ± 6 μ sec for radar correlation work. Units are supplied as unity gain packages complete with drivers, amplifiers and shapers.	MS283	30.5	4	12, 15, 18, 30	4 x 12 x 1.5
	MS402	48.0	6	2, 5, 8, 12, 14, 48	5 x 10 x 2.75
	MS399	16.3	3	6, 12, 16	4 x 12 x 1.5

DISTRIBUTED CONSTANT DELAY LINES

DD680 SERIES NANOSECOND MODULES

	Delay Choice Nanosec.	Impedance Choice Ohms	Delay to Rise Time Ratio	Size
DISTRIBUTED CONSTANT — Epoxy encapsulated. Temperature coefficient less than 120 PPM/°C. Case size depends on delay to rise time ratio.	5, 10, 20, 30	93, 330	5:1	.5 x .31 x 2.25
	40, 50, 60, 70 80, 90, 100	500, 1000	10:1	1.0 x .31 x 2.25

DD679 SERIES MICROSECOND MODULES

	Delay Choice Microsec.	Impedance Choice Ohms	Delay to Rise Time Ratio	Size
DISTRIBUTED CONSTANT — Epoxy encapsulated. Temperature coefficient less than 120 PPM/°C — Can be cascaded to obtain longer delays — other delays and impedance available.	.1, .2, .3, .4, .5	330, 500	5:1	.5 x .375 x 4.5
	.6, .7, .8, .9, 1.0	1000	10:1	1.0 x .375 x 4.5
	2.0; 4.0; 5.0; 10.0	500, 1000	10:1	1.0 x .5 x 4.5

INFINITE RESOLUTION VARIABLE REEL DELAY LINE

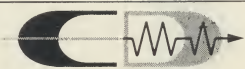
	Model	Delay Range 3 db Nanosec.	B.W. Mc	Resolu- tion	Impe- dance Ohms	Attenu- ation Db	Size
DISTRIBUTED CONSTANT — With input and output impedance of equal value — can be spliced directly into interconnecting coaxial cables — IDEAL PHASE SHIFTER. Usable to 200 Mc — Single shaft control — BNC connectors.	DV581	2-50	70	Infinite	200	1	1.0 x 1.75 x 5.37
	DV576A	2-50	70	Infinite	93	1	1.0 x 1.75 x 5.37

DELAYS UP TO 100 NANOSEC. AND OTHER IMPEDANCES ALSO AVAILABLE.

HIGHEST QUALITY • FASTEST DELIVERY

This condensed catalogue information is only meant to serve as a guide. Before finalizing on a design it is most prudent to utilize the experience, ingenuity and up-to-date information of our Engineering Staff. Expert guidance, which can save you hours of searching, is as close to you as your telephone —

Telephone:
 516 AR 1-0666
 TWX:
 516-421-4235



COMPUTER DEVICES CORP.